REPORT FROM THE TASK GROUP ON THE ENVIRONMENTAL INDUSTRY

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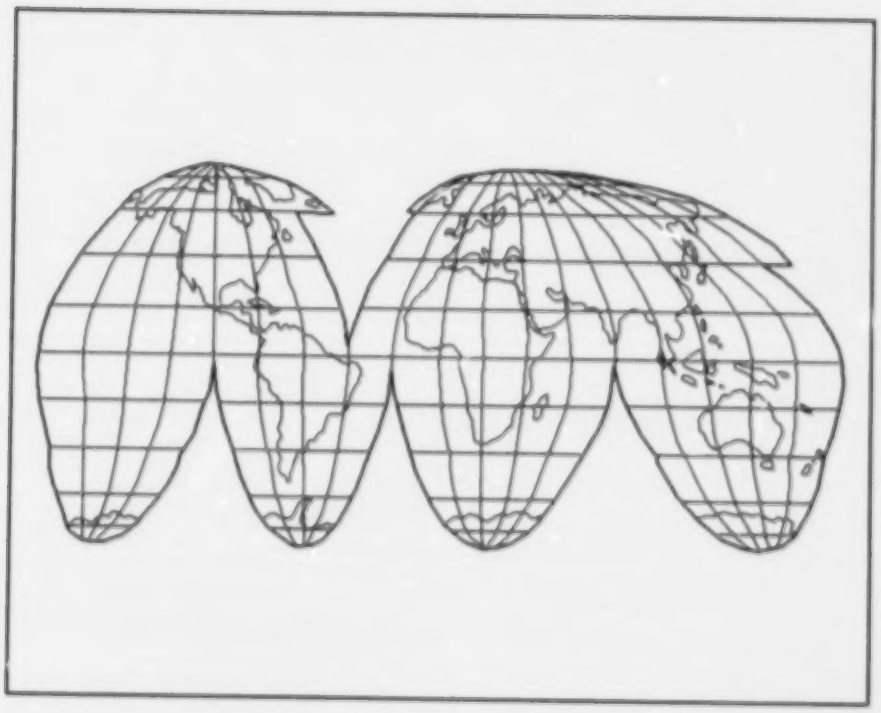

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ACKNOWLEDGEMENT

In August 1990, a Task Group on the Environmental Industry was established in order to identify key technological opportunities and constraints to the development of the Environmental Industry in New Brunswick, and to recommend appropriate measures to stimulate and accelerate development of this industry. Funding for Task Group expenses was provided under the Canada/New Brunswick Subsidiary Agreement on Industrial Innovation and Technology Development. Members of the Group gave freely of their time, expertise, and guidance in the compilation of this report.

The Task Group wishes to acknowledge and thank the numerous contributors who assisted in the study and to extend a special thanks to the Department of Commerce and Technology and the Atlantic Canada Opportunities Agency for giving the opportunity to provide this input.

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EXECUTIVE SUMMARY

The Task Group was formed in mid-1990. The scope of the work was to identify those aspects of the environmental industry which presented opportunities for new or improved processes, products or services which were potentially attractive to the industry in New Brunswick.

The environmental industry is estimated by Peat, Marwick, Stevenson and Kellogg (KPMG) to have an annual value of $95 billion in the USA, $8.5 billion in Canada and $2.5 billion in Mexico (US dollars). This is slightly larger than the continent's aerospace and aviation industry. Most impressive is its growth rate of 7% per year. The solid and hazardous waste management sectors are the fastest growing. KPMG likens the environmental industry to "a pot of water that has been rising in temperature and nothing much happens until suddenly it reaches the boiling point." "In 1987, 2% of Canadians felt that the environment was the number one issue. In 1988, the figure rose to 10%, and in 1989, fully 29% of Canadians rated the environment the number one issue."

Water supply and wastewater treatment facilities have traditionally received the lion's share of the resources but over two-thirds of these facilities do not meet national water quality standards.

Air management is the largest sector and is projected to grow 5% per annum, continent wide. Emerging technologies include microbial cleaning processes, electron beams to remove flue gases, and coal gasification systems. The US Clean Air Act and Canada's commitment to halve sulphur dioxide emissions by 1994 will be a major boost.

Hazardous waste management attracts a lot of national attention but this Province generates a very small portion compared with the more industrialized regions. Opportunities arise in the areas of biological degradation and advanced information systems to record data.

Many aspects of land management require massive changes in the way things are done. Erosion control, reforestation, shoreline and coastal rehabilitation, pit mining sites, are but a few.

A growing awareness of the detrimental side-effects of pesticides is causing a shift toward non-chemical controls.

Geographic Information Systems is a powerful tool to manage data for environmental control and monitoring.

The solid waste management field is the fastest growing sector in the North America environmental industry. The most promising business prospects in this field appear to be in recycling. Interest is exploding, requiring new infrastructure improvements to recover and process recyclable materials. There will be opportunities to remanufacture or reprocess those materials into new products with recycled content, particularly for paper and plastic. Composting is a low form of recycling that will have huge potential. Even if the resulting compost has a sale value, it still has the economic value of tipping fee avoidance. Waste-to-energy plants are very costly and are likely to face opposition from the public.

In addition to the business activities normally associated with environmentally related topics mentioned above, there will continue to be opportunities in other sectors such as waste reduction and reuse, the elimination of paper in business transactions, reusable envelopes, redesign of the waste end of buildings.

The task group considered the overall make-up of the industry and identified opportunities which, in the opinion of the group, were particularly applicable to New Brunswick considering its natural resources, its centres of expertise and the vacuum which appears to exist in certain fields. The opportunities which were deemed to offer the greatest potential to the provincial environmental industry have been identified. This listing is not totally inclusive.

Also recognized were the lack of incentives to adequately support the research and development of new processes and equipment. The group identified the positive aspects of privatization of certain operations of Government.

Recommendations have been made with respect to actions which may be taken to assist and improve the environmental industry to thrive in this Province and to enable it to export goods and services to other jurisdictions. These recommendations have been prioritized as A (high), B (medium) and C (low). The Province is asked to:

A - recognize the Environmental Industry as a vital segment of the business community with entrepreneurial opportunities for the enhancement of the environment in the Province and the export of related products and services to other jurisdictions;

A - increase resources in the environmental industry sector within the Department of Commerce and Technology by refocusing resources from existing participating sectors;

A - assist in the formation of an Association of environment industries;

A - establish, in consultation with the industry association, a directory of environment related producers of goods and suppliers of services;

C - seriously consider the report, The Role for Geomatics in Environmental Management by the Champlain Institute for implementation in N.B. in view of the currently high level of attainment and its potential for export;

C - install one or more total material handling systems in the Province to demonstrate mechanical separation techniques and to provide a testing facility for N.B. manufacturers;

A - recognize recyclable material not as waste but as a semi-processed material which can be further processed in the Province with maximum attainable value added;

A - take steps to have the real cost of the disposal of waste borne by the waste generators so as to encourage the growth of the recycling industry;

B - direct every provincially supported organization to participate fully in community recycling programs and be a model for the rest of the community;

A - develop in consultation with industry, a management plan to maximize the utilization of scrap paper in a manner which contributes most to the economy of the Province;

C - encourage the extraction of carbon black and/or other products from automotive tires which cannot be retreaded;

C - consider, in consultation with the petroleum industry, the establishment of a waste oil re-refining facility to serve the Region;

A - assess the total opportunity and fund the installation of programs designed to maximize composting as a means of waste utilization.

C - encourage manufacturers to publish life cycle costs on their goods and assist NB consultants to become knowledgeable in this field;

B - encourage all private and public agencies to conduct an environmental audit and monitoring of their activities.

A - make funds available to improve the efficiency of waste collection and to demonstrate sorting and processing. Demonstrations projects already exist but it appears necessary to test known procedures in this Province;

B - encourage the manufacturing of suitable products specifically for the treatment of contaminated soils and groundwater through the provision of financial incentives and the awarding of Provincial Government contracts.

A - provide aid and give preference to the development of new and innovative processes to effect environmental remediation, through existing environmental initiatives.

A - promote environmental consulting and contracting services within the Province, Atlantic Canada and the New England States through Industry and government liaison with appropriate contact groups. Promotion can be generated through direct contact and the production of promotional literature and an environmental industries directory.

A - continue to support research and development of alternative space heating technologies, and also initiate the adoption of appropriate standards for the design and installation of ground source heat pump systems and others as required.

A - support Research and Development toward improved refrigerants and refrigerant handling systems and put legislation in place to ensure that New Brunswick residents take the necessary measures to stop venting of CFCs into the atmosphere.

B - study the feasibility of privatizing those sectors of the environmental industry which are currently operated by departments or publicly-owned agencies.

B - form a study group composed of at least 2/3 private sector representatives, empowered to obtain information on the successes and failures of privatization programs elsewhere and be provided with an adequate secretariat and budget;

A - review various government policies which impact on the environmental industry and institute a system of incentives/disincentives to meet environmental goals and allow market forces to work.

B - continue and increase incentives and support toward enhancement of the more desirable forms of waste management according to the accepted hierarchy;

C - undertake an inventory of industrial waste generation and assess the quality and quantity of each source for possible commercialization. Support should also be given to the establishment of a By-products Exchange in the Province;

A - introduce an R&D incentive similar to the Unsolicited Proposal Program that can be accessed by persons in the Environmental Industry in New Brunswick. The essential features are that the program should recognize the total cost of the R&D project (including overhead) and that it should fund nearly 100 percent of the total cost of the project.

One mechanism for establishing the R&D incentive would be through a renewed Industrial Innovation and Technology Development Sub-agreement.

A - establish, in consultation with the universities and industry, a system for grants to individual researchers based on proposals which would demonstrate the potential for commercialization;

A - continue to assist in the funding of universitie's environmental research infrastructures.

A - increase support for developmental research proposed jointly by industry associations, industries and universities.

A - continue to support Provincial research organizations in terms of infrastructure.

CHAPTER I

HISTORICAL OVERVIEW

A Characterization of the Environmental Industry in Atlantic Canada by Nolan, Davis & Associates (N.S.) Limited has recently been completed for Industry, Science & Technology Canada. The study was based on the same environmental industry classification as this study.

> It is estimated that there are 354 firms in the industry in New Brunswick with total annual sales of $152 million, 52% of which is in waste handling and environmental facility operation, 15% in the supply of goods, and 33% in the supply of other services. This represented 21.3% of the Regional total compared with 42.4% for Nova Scotia. The total value of fixed capital is reported as $108 million for New Brunswick representing 13.9% of the total for the Region, less than one quarter of the reported value for Nova Scotia. Employment is in excess of 2 000 in New Brunswick. Sales per employee were the lowest of all provinces, 78% of the regional average.
>
> The increasingly competitive nature of the marketplace will place innovation and quality at a premium in the 1990's in regional as well as in national and export markets. "In light of the competitive pressures now being unleashed in the market for environmental goods and services, an increase in environmental industry research and development seems mandatory."
>
> Growth rates of 13.5% per annum in sales are anticipated for each of the next five years. The industry would therefore appear to offer excellent potential for economic growth in the Region, although the low levels of R&D expenditure as a percent of sales by the industry (NB 2.7%, NS 2.0%, PEI 2.0% and Nfld 9.1%) should be a source of concern in this regard. Firms in the region which do engage in R&D activity show such expenditures to be 12% of sales, and these firms on average anticipate an 18% growth rate.

The North American market, over $100 billion and growing rapidly, has the potential to provide many opportunities to local firms but will also feature

increasingly intense competition within the Region from foreign firms which have developed expertise within larger home markets and also enjoy higher levels of R&D support than generally available within New Brunswick.

The inevitable full awakening of U.S. firms to the range of opportunities which lie in the provision of environmental goods and services will make all markets that much more competitive. In light of this, an increase in environmental industry research and development seems mandatory.

During the last two decades the public has undergone a tremendous change in attitudes to environmental issues. In the beginning these were generally of a local nature, sewage treatment, landfills and the occasional industrial waste flare-up. Acid rain in eastern North America raised awareness of the international nature of the pollution problem. Then it was the depletion of the ozone layer and its potential result on human health. More recently, the possibility of global warming has caused widespread concern over potentially related effects such as coastal flooding, increased hurricane activity, droughts, ecological changes, and associated socio-economic dislocations. Global warming is believed to be due to the build-up of greenhouse gases, principally carbon dioxide, as a result of the combustion of fossil fuels for transportation, electricity generation, heating, and other uses, as well as from natural causes.

Warnings of limits to uncontrolled use of the biosphere are not new. In 1798 Thomas Malthus predicted that population growth could not continue without over utilization of natural resources. In 1915 Canada's Commission on Conservation wrote: "Each generation is entitled to the interest on the natural capital, but the principal should be handed on unimpaired". In 1972 the United Nations Conference on the Human Environment, in Stockholm, declared, "the capacity of the earth to produce vital renewable resources must be maintained." Also in 1972 the Club of Rome issued its now famous book, The Limits to Growth which said that water, land, forests, minerals and the oceans are "the ultimate determinants of the limits to growth on this earth. In 1973 the Science Council of Canada gave us the phrase , "conserver society". The 1980 World Conservation Strategy warned that the destruction of natural resources eliminates future sources of food, medicines and industrial products.

But it was the 1987 report of the United Nations World Commission on Environment and Development, Our Common Future., that found fertile ground in Canada. The Commission represented twenty one nations and was chaired by Dr. Bruntland, Prime Minister of Norway. The report is sometimes referred to as the Bruntland report.

The Bruntland Report clearly and for the first time enunciated the necessity of "merging environment and economics in decision making". In order to pay for a healthy environment we must have a healthy economy.

The Club of Rome predicted gloom and doom, a lower standard of living. But the "Bruntland Report says that people can build a future that is more prosperous, more just, and more secure. The report is not a prediction of ever increasing environmental decay, poverty and hardship in an ever more polluted world among ever decreasing resources. It sees instead the possibility for a new era of economic growth, one that must be based on policies that sustain and expand the environmental resource base".

Subsequently, the Canadian Council of Resource and Environment Ministers formed a National Task Force on Environment and Economy which included ministers, business executives, environmentalists and academics. The Task Force report included several recommendations among which were:

- **increasing recycling and improving waste disposal;**

- **developing business task forces on environment-economy linkages and the creation of environmental principles and policy guidelines;**

- **creating demonstration projects to show how to implement the environment-economy linkages.**

The report also suggested that the Prime Minister, premiers and territorial leaders appoint round tables on environment and economy across Canada.

Experience in the industrialized nations has proven that anti-pollution technology has been cost-effective in terms of health, property, and environmental damage avoided, and that it has made many industries more profitable by making them more resource-efficient. While economic growth has continued, the consumption of raw materials has held steady or even declined, and new technologies offer further efficiencies.

A strategic imperative "for sustainable development is the need to integrate economic and ecological considerations in decision making. They are, after all, integrated in the real world".

Implementation of sustainable development strategies throughout the world and particularly in North America will have economic implications on all

jurisdictions. There will be shifts of industrial activity. Economies which rely heavily on natural resources will be at greater risk, but there will also be opportunities both for domestic and export services and products.

There would be no environmental industry if our society did not increasingly recognize the need to protect the environment for the good of future generations. The past century has experienced exponential growth in the ability of mankind to really affect the physical world in a global sense. And it has only been in the last two decades that the messengers have been given an audience.

The time has now come for the people of New Brunswick to more actively participate in remedying the excesses of the past and to ensure the well-being of future generations.

The focus of this study is to identify those opportunities in the Environmental Industry which may be exploited through entrepreneurial initiatives and those measures to achieve their realization.

TERMS OF REFERENCE

The Canada/New Brunswick Subsidiary Agreement on Industrial Innovation and Technology Development was signed on May 28, 1986. The Subsidiary Agreement came about as the result of a recommendation from a study by A.D. Little of Canada Ltd. entitled "New Brunswick's Science and Technology Strategy", and by the Province's commitment to technology transfer as a means of strengthening its strategic technology resources and stimulating industrial growth in the Province.

The overall objective of the Subsidiary Agreement is to accelerate the development and the application of technology to increase and enhance employment opportunities in New Brunswick. In pursuit of this objective, the Sub-Agreement strives to maximize private sector participation. Towards this end, it encourages the private sector and other key participants (such as the academic community) by involving them in the prioritization process and the establishment of strategic objectives, targets and action plans.

The Government of New Brunswick has recognized the Environment in "Towards 2000, An Economic Development Strategy for New Brunswick" as one of the basic thrusts in that economic development strategy.

Mandate of the Task Group

The task group is to recommend to the Management Committee of the Industrial Innovation and Technology Development Subsidiary Agreement, a plan of action for the Province. This would then provide the proper stimulus for technology development in the areas of environmental services and product manufacturing as a way of increasing locally based competitiveness within the industry and of promoting in-Province diversification.

Objectives

1. To identify key technology strengths and opportunities for developing new or improved processes, products or services and to prioritize these in terms of their contribution to the Sub-Agreement's objectives, namely,

    - improving the competitiveness of the industry
    - diversifying the existing industry
    - establishing new products and services

- creating employment in research and development.

2. To identify and prioritize measures necessary to assist the private sector in the development and application of new and existing technology.

Scope

The task group shall direct its efforts towards the promotion of new R&D initiatives built on existing areas of strength within the environmental industry in the Province and the examination of new, potentially attractive processes, products or services to meet both requirements of emerging or existing environment regulations and the demands of the market place.

Approach

1) Identify and assess current and emerging technology that will stimulate the growth and development of the environmental industry of New Brunswick.

2) Identify and assess relevant new market niches and market trends.

3) Identify and assess the technology needs of the industry to improve its competitiveness and identify the major constraints impeding the development of new and improved methods, products or services.

4) Identify niches where there is potential for developing a world-class industry and identify where New Brunswick should develop a capability to support technology needs of its industry at such a level.

5) Assess the ability of existing R&D facilities in both the public and private sectors in New Brunswick or the region to meet the development requirements of the industry.

6) Assess the strength of the collaboration and linkage between existing R&D facilities, the universities and industry to ensure the successful transfer of technology.

7) Identify activities to be undertaken jointly by R&D centres and the private sector to foster better communication and transfer of technology.

Recommendations

1) Identify and prioritize those areas and activities deemed to best respond to the needs of the market place considering the opportunities, constraints and areas of strength outlined above.

2) Identify measures to increase the exchange of knowledge and transfer of technology from R&D performers both in New Brunswick and outside the province to the private sector.

3) Recommend specific projects and activities as part of a plan of action and prioritize them according to resultant benefits and costs.

4) Identify, in addition to needed support from the Sub-Agreement, the role and participation of government, the private sector, universities and R&D centres in the realization of this plan of action.

5) Recommend funding options and mechanisms.

6) Identify the areas of environmental services and manufacturing that can be strengthened to ensure the New Brunswick industry a competitive advantage.

CHAPTER II

DEFINITION OF THE ENVIRONMENTAL INDUSTRY

The Environmental Industry has been defined as those establishments, both private and public, which provide research, measurement, monitoring, planning, design, construction and management services and/or which design, manufacture, install or maintain products that have as their major effect the conservation, protection or enhancement of the natural environment and those establishments involved in the collection, analysis and dissemination of environmental information such as weather and climatological services.

MAIN ORIENTATIONS

The Environmental Classification of goods and services as developed by Industry, Science and Technology Canada (ISTC) was accepted by the Task Group as an initial reference point in its deliberation.

This classification was screened to identify those products and services which might be applicable to the Environmental Industry in New Brunswick. This listing is found in the Appendix.

The Group determined that a shorter list of products and services which present a higher potentiel for commercial opportunities in New Brunswick is as follows:

Products	ISTC #
Air pollution control	1.0
Air Handling Equipment	1.2
Computer Software Programs	1.6
Air Pollution Filter Accessories/Media	1.9
Water Pollution Control	2.0

Products	ISIC #
Aeration Systems	2.1
Biological Treatment Systems	2.2
Chemical Recovery Systems	2.5
Computer Software Programs	2.6
Filter Media	2.8
Gravity Sedimentation Systems	2.9
Potable/Process Water Treatment Systems	2.12
Sewage Treatment Systems - Municipal (packaged)	2.15
Water Purification Systems and Equipment	2.17
Waste Management	3.0
Computer Software Programs	3.1
Recycling Systems and Equipment	3.3
Waste Disposal Systems and Equipment	3.6
Chemicals for Pollution Control	5.0
Absorbents/Adsorbents	5.1
Bacteria/Enzymes	5.3
Water Treatment	5.7
Instruments for Pollution Control	6.0
Air Pollutant Detection/Measurement	6.1.2
Water Quality and Emission Parameters	6.1.6
Sampling Systems and Equipment	6.2
Scientific Research and Laboratory	7.0
Laboratory Reagents and Supplies	7.6
Natural Resources Conservation and Protection	8.0
Reforestation	8.1
Remote Sensing and Image Analysis	8.2
Computer Software for Natural Resources Conservation and Protection	8.3

Services	ISTC #
Consultant Services	1.0
Consultant Engineering Services	1.1
Site Reclamation and Remedial Action	1.1.9
Research and Development	1.1.12
Consultant Services - Environmental	1.2
Alternative Energy Sources	1.2.1
Clean-up Criteria Development	1.2.2
Contingency Planning for Spills	1.2.3
Emergency Response Planning	1.2.4
Energy Conservation	1.2.5
Environmental Audits	1.2.6
Environmental Impact Assessments	1.2.9
Environmental Law	1.2.11
Environmental Monitoring	1.2.13
Pollutant Transport/Transformation Studies	1.2.19
Risk Management	1.2.20
Spills Assessment and Clean-up	1.2.21
Underground Storage Tank Management	1.2.23
Consulting Services - Waste Management	1.3
Aquifer Remediation	1.3.1
Consulting Services - Other	1.4
Computer Software (including expert systems)	1.4.1
Data Base Management Systems	1.4.3
Environmental Data Acquisition Systems	1.4.5
Indoor Air Quality	1.4.8
Pollution Assessment and Control	2.0
Waste Handling and Environmental Facility Operation	4.0
Recycling	4.4
Waste Management	4.5

Products	ISIC #
Laboratory and Related Field Services	5.0
Laboratory Sampling, Monitoring and Monitoring Services	5.2
Ambient Air	5.2.1
Stack Emissions	5.2.8
Electromagnetic Interference	5.2.10
Environmental Research	6.0
Federal Government	6.1
Private Sector	6.2
Provincial Government	6.3
University	6.4
Natural Resources Conservation and Protection	7.0
Forestry	7.3
Forestry Conservation and Protection	7.3.1
Land	7.4
Geographic Information Systems	7.4.2
Mapping and Resources, Land Types and Land Use.	7.4.3

CHAPTER III

POTENTIAL OPPORTUNITIES IN NEW BRUNSWICK

The group considered the listing of goods and services of the previous chapter as well as suggested opportunities for the country and the region. A rigorous sifting of this information in the context of the experience and judgement of the group resulted in the identification of fifteen opportunities which were deemed to offer the best potential for exploitation by the Environmental Industry in New Brunswick. These include the further development of and application for:

1. Geographic Information Systems (GIS) involved in mapping and the management of natural resources through computer based technology;

2. equipment, processes and services which collect and transform waste into useful products. Opportunities presently exist in the extraction of metals from mine tailings, the transformation of fish waste into useful products, the recovery of refrigerants from salvaged equipment, and the collection of special forms of recyclable material in municipal solid waste;

3. marketing of knowledge intensive products relating to sustainable development use of forest resources;

4. energy conservation for private and public institutions specially in heat recovery systems, multi-fuel furnaces, and private sector generation of electricity;

5. marketing of education/communication services specializing in public relations related to issues in environmental/conservation initiatives and for educators specialized in subjects related to the environment;

6. technical consulting services in areas such as controlled use of chemicals, aquaculture operations, environmental remediation;

7. environmental/waste auditing as it relates to permits and licensing of property transfer and compliance and management for waste and storage monitoring;

8. processes and products for the treatment of effluent discharges;

9. processes and products for the treatment of water;

10. technical services consortia to facilitate the export of environmental technologies developed by New Brunswick firms;

11. provision of analytical services to the Environmental Industry regulatory agencies and to process industries that are required to manage environmental problems;

12. material handling and processing equipment in New Brunswick, focusing on the automation problems connected with recycling and waste management;

13. recycling and the manufacture of useful products from secondary material - paper products, glass, metal, plastics, automobile tires, motor oil, construction material, composting.

14. utility operations for service packages in response to calls for tenders by provincial and municipal governments for contracts that can easily be provided by the private sector.

15. provision of processes and products for the treatment of contaminated soils and ground water using proven and innovative technology and experienced personnel.

CHAPTER IV

RECOMMENDATIONS

INTRODUCTION

This chapter contains the rationale behind the various recommendations being made to the Province.

These recommendations are arranged in two groups, first - measures necessary to assist the private sector in the development and application of new and existing technology in the Environmental Industry and second - measures for developing new or improved processes, products and services.

Within these two groupings, the individual recommendations are prioritized as deemed most important to the Industry.

RECOGNITION OF THE ENVIRONMENTAL INDUSTRY SECTOR

The demand for environmental services and products is as widespread throughout society as is the demand for electrical energy. Rather than being supplied by a single regulated producer, however, environmental products and services are provided by a whole array of relatively small, specialized firms, as well as companies in traditional sectors which include these products as part of their product mix.

For example, nearly any metal manufacturer can adapt its production line to manufacture components that conserve, protect, or enhance the environment. Most laboratories can be made to focus on measuring and monitoring pollution.

This is why it is difficult to isolate companies engaged in the environmental sector. It is clear, however that the industry is growing and its profile is ascending.

It is recommended that the Province recognize the Environmental Industry as a vital segment of the business community with entrepreneurial opportunities for the enhancement of the environment in the Province and the export of related products and services to other jurisdictions.

It is recommended that the Province increase its resources in the environmental industry sector within the Department of Commerce and Technology by refocusing resources from existing participating sectors.

It is recommended that the Province facilitate the formation of an environmental industry association by providing seed money and services during the initial stages.

It is recommended that the proposed sector group, in consultation with the industry association, establish a directory of environment related producers of goods and suppliers of services.

GEOGRAPHIC INFORMATION SYSTEMS

Geographic Information Systems (GIS) is a powerful tool to assess and develop many aspects of our natural resources and environment. The Champlain Institute has commissioned a report, The Role for Geomatics in Environmental Management by John Henderson, January 1991.

There is a need to evaluate existing information and to prepare a detailed inventory of maps, data sets and data bases relating to geography, distribution of natural resources, and ecological and environmental variables.

Research and development is needed to define the roles of the various stakeholders to develop access and interaction modes, to demonstrate the power of GIS as a communication tool and to commercialize the system.

Key potential users are not experts. An integrating influence is needed to bring together all the players to optimize the application to resource and environment issues.

It is recommended that the Province seriously consider the report of the Champlain Institute for implementation of GIS in N.B. in view of the currently high level of attainment and its potential for export.

WASTE MANAGEMENT

Recycling Systems and Equipment

Equipment for recycling is being developed worldwide, but there is opportunity for adaptation to the needs of smaller communities. Since all secondary materials originate with a generator and, for purposes of collection they become commingled with other products they must be separated and processed to suit the specifications of the purchaser who intends to further process the material into consumer products. Source segregation and careful handling reduce separation costs and enhance the value of the product. The material stream considered in this section consists only of recyclable material.

The total system includes collection, processing in a recycling centre, or intermediate processing facility, shipping and, in certain cases, manufacturing.

Some equipment can be manufactured locally, such as can flatteners and glass smashers.

It is recommended that the Province install one or more total material handling systems in the Province to demonstrate mechanical separation techniques and to provide a testing facility for N.B. manufacturers.

Recycling

Tinned cans can be de-tinned in a relatively simple process. Both the tin and the steel have considerable value.

Glass is generally remoulded into bottles but it could also be made into spheres for reflective paint or into glass wool for insulation.

Non-ferrous metals are often shipped out of the province in an uncleaned state. Value added by cleaning is high.

Used lubricating oil can be re-refined into a replacement oil of a quality equal to or better than the original.

Ethylene-glycol antifreeze can also be reconstituted.

Rubber tires can be processed to remove the volatile and carbon black. They can also be used in pavement.

Plastics of all kinds can be remoulded. PolyEthylene Terephthalate (PET) can be broken chemically and made into polyester resin or a polyol foaming agent. Mixed plastic can be used as a feed-stock for the manufacture of thick-walled non-food containers.

Bricks can be crushed for decorative mulch.

Wood waste can be ground or pulverized for use as fuel, mulch or in the composting process.

Paper which is sorted by grade has an established market. Mixed paper can be re-pulped and converted to egg cartons, fast food trays and other formed products. Towelling and other fibre products with a low appearance specification can be made from this material.

It is recommended that the Province recognize recyclable material not as waste but as a semi-processed material which can be further processed in the Province with maximum attainable value added.

It is further recommended that the Province take steps to have the real cost of the disposal of waste borne by the waste generators so to encourage the growth of the recycling industry.

It is also recommended that the Province direct every provincially supported organization to participate fully in community recycling programs and be a model for the rest of the community.

It is recommended, that in the case of scrap paper, the Province in consultation with industry, develop a management plan to maximize the utilization of this material in a manner which contributes most to the economy of the Province.

It is recommended that the Province encourage the extraction of carbon black and/or other products from automotive tires which cannot be retreaded.

The Canadian Petroleum Association has proposed a program whereby used lubricating oil, chiefly crankcase oil, could be collected and recycled for reuse.

It is recommended that the Province, in consultation with the petroleum industry, consider the establishment of a waste oil re-refining facility to serve the Region.

Composting

This is the recycling of organic materials such as kitchen waste, sludge, animal and yard waste, used tissues and paper towels, food waste such as from fish, meat and agricultural processes, farm manure and such into nutrient and humus rich products.

The advantages of such a program are broad. In addition to reducing the volume of material going to a landfill and the contamination of ground water and streams, this product could replace chemical fertilizers and improve the tilth of the soil.

It is recommended that the Province assess the total opportunity and fund the installation of programs designed to maximize composting as a means of waste utilization.

Consulting Service

There is a growing awareness on the part of the industrial, commercial and institutional (ICI) sectors that each organization must do its part in providing the solution to the problem of waste.

The Canadian Chamber of Commerce recommends that its member associations and companies "set an example by undertaking their own environmental audit and improvement programs. These could include energy and waste audits in their offices, backed up with a commitment to energy efficiency and recycling".

The audits should be extended to all aspects of ICI activity. Audits by independent groups would add credibility to the results and this segment of the Environmental Industry, in concert with appropriate government bodies, should establish standards.

The growing awareness of the user pay philosophy will create a need for life cycle costing of consumer products from "cradle to grave." This may be a

considerable opportunity for consultants who are competent, with the proliferation of approaches of the current era.

It is recommended that the Province encourage manufacturers to publish life cycle costs on their goods and assist NB consultants to become knowledgeable in this field.

It is recommended that the Government encourage all private and public agencies to conduct an environmental audit and monitoring of their activities.

Waste collection

There is an opportunity in each region for specialty collection of waste, both residential and commercial.

A packer-type truck could make rounds collecting only old corrugated containers from business, only mixed office waste, automotive and industrial waste and restaurant waste, each separately.

Residential waste, urban and rural, might be collected in three-compartment vehicles using three colour coded household containers - one for wet compostable material, one for dry recyclable material, and the third, trash for landfilling.

The 'blue box' system for collection of recyclable materials is widely used. It involves the distribution of the various items into bins on a specially designed and expensive vehicle. Further sorting at the processing facility is minimal.

The 'blue bag' system uses standard inexpensive vehicles to collect material which has been source-segregated into identified categories and placed in semi-transparent blue plastic bags. All further sorting is done in a processing facility using a combination of manual and mechanical operations.

Another widely used option for collection of recyclable material is the use of bins or drop-off depots. Material is taken to the site by the public and is deposited in bins specifically marked for particular classes of products.

This has the advantage of being very inexpensive and works well for participants. However, it has disadvantages. The participation rates tend to be lower than for curbside collection systems and the range of materials collected tends to be narrower. Unless the depot is adjacent to a normally travelled way it becomes

inconvenient and also is not energy efficient. Depots must be in controlled locations to restrict vandalism.

It is recommended that the Province make funds available to improve efficiency of collection and to demonstrate sorting, processing and composting. Demonstration projects already exist but it appears necessary to test known procedures in this Province.

SITE RECLAMATION AND REMEDIAL ACTION

Soil and groundwater clean-up is a growing opportunity for industry requiring both proven technologies and equipment and experienced personnel. The number of products available to effect soil clean-up and treatment has quadrupled in the last ten years, commensurate with the increase in demand for contaminated site clean-up and more cost-efficient and effective methods.

New products, equipment and processes used in the measurement of contaminants, the collection of contaminants from the groundwater, the treatment of contaminated soils, the disposal and immobilization of contaminants is required to reduce present costs and allow greater public acceptability. Manufacturing of environmental equipment for soil and water treatment is ideally suited to the Province of New Brunswick considering the present base manufacturing capabilities available.

It is recommended that the Province encourage the manufacturing of suitable products specifically for the treatment of contaminated soils and groundwater through the provision of financial incentives and the awarding of Provincial Government contracts.

The application of environmental treatment equipment and products requires that appropriate processes be developed.

It is recommended that the Province provide aid and give preference to the development of new and innovative processes to effect environmental remediation, through existing environmental initiatives.

It is recommended that the Province promote environmental consulting and contracting services within the Province, Atlantic Canada and the New England States through Industry and government liaison with appropriate contact groups. Promotion can be generated through direct contact, through promotional literature and an environmental industries directory.

Provision of consulting and contracting services and equipment for currently identified site remediation and clean-up is expected to be close to $200 billion in the USA. Clean-up of Canadian sites may reach as high as $30 billion.

Assessment of the pace of clean-up and of effectiveness of treatment methods used creates demands for both equipment and monitoring methodologies. While

there is a plethora of environmental monitoring equipment on the market, some areas of environmental measuring and monitoring still remain to be addressed.

ENERGY EFFICIENCY FOR HEATING

Space heating in the prevailing New Brunswick climate presents a seasonal demand upon the supply of electricity which extends over some six (6) months of the year. This demand can be moderated by the use of alternative heating systems to resistance space heating, including such systems as ground source heat pumps and air to air heat pumps.

Concerns have been emerging with respect to the potential environmental effects of such systems; in particular, the effects of heat pumps upon groundwater resources is being carefully examined. The adoption of installation standards and associated quality assurance and inspection programs would appear to be desirable, and could lead to considerable demand for services to implement such measures as the technology becomes more established.

It is recommended that the Province continue to support research and development of alternative space heating technologies, and also initiate the adoption of appropriate standards for the design and installation of ground source heat pump systems and others as required.

REFRIGERANTS

The Montreal Protocol of 1987 clearly stipulates that production of ChloroFluoroCarbons (CFC) shall be gradually reduced to nothing by the year 2000. In fact a lot of the signing countries have advanced this date to 1997.

Refrigerants must be recovered from discarded and/or serviced equipment which uses these CFC's. Manufacturing and market availability of specialized CFC recovery equipment has become an essential activity during the phase-on period of the protocol.

Refrigerant management will eventually mean the recovery of refrigerants now being released accidentally to the atmosphere or released as a result of refrigeration units being discarded in landfills. Efficient equipment which can recover, clean, and recharge refrigerants is now being produced in New Brunswick. These units can remove the moisture and acidity from refrigerants now used in equipment such as automobile and home air conditioning systems, and household refrigerators. In cases where units are being decommissioned, the refrigerant can be saved and sold to the original producers for remanufacture and resale.

Further research and development is needed to develop recovery equipment which is functional in a service application and which provides the service technician with a useful user friendly tool to achieve the elimination of venting CFCs. The Province should create incentives for the manufacturing of such equipment and help contractors or service technicians who purchase such equipment.

It is recommended that the Province support research and development toward improved refrigerants and refrigerant handling systems and that the Province put legislation in place to ensure that New Brunswick residents take the necessary measures to stop venting of CFCs into the atmosphere.

WASTE HANDLING AND ENVIRONMENTAL FACILITY OPERATION

Privatization of services and operations

Governments at all levels, are involved in the provision of many environmental services. In many jurisdictions these services are provided by the private sector. In certain cases, it may be better to contract the management of a facility, in others it may be better to have private ownership. If the operation does not lend itself to private sector competition it may be deemed best to have it operated as a private sector utility.

It was recognized that a number of reasons have been put forward in the past against such privatization. Such reasons as inadequate instrumentation, lack of coordinated quality assurance programs, and inadequate training programs have been the chief factors against privatization. Problems such as the ones outlined are handled through standardization. The Department of Health and Community Services, for example, has privatized potability water testing for mortgage purposes and all laboratories eager to perform such services must meet requirements set by the lending institutions.

A potential opportunity for development of private utility operation companies is being blocked by restricting such activities to the public sector. Private companies are common in the United States. They are currently being formed by privatisation in the United Kingdom, in response to the realisation that more efficient service can be obtained through the private sector.

It is time saved, money realized when private companies take over such services that are currently performed by governments. If government is looking at ways to reduce costs, privatization of services that allows the clients to contribute towards the costs is the way to go.

Areas that can easily be privatized include water testing for non-sophisticated pollutants such as heavy metals etc., potability test that covers all homes and municipal water services and not restricted to mortgages only; food poisoning and testing services for restaurants and public eating houses; industrial wastes. It would be essential to have as a requirement for continued operation of a number of eating houses a document indicating quarterly auditing of the locations. The same type of approach is needed in the industry where significant pollution is likely to originate from, e.g., pulp mills, food processing factories and establishments, meat packing firms and even vegetable canning factories.

The concept of privatization can be extended to many operational functions of government, to small facilities such as recreational parks, schools, industrial parks and municipalities as well as to large systems including water supply, sewage treatment, waste collection, recycling facilities, landfill disposal, analytical services, and more.

If provincial and municipal governments were to adopt such options in New Brunswick many benefits could arise including:

-reduction of public debt;
-reduction in the size of government;
-cost savings;
-creation of new private sector employment;
-creation of new companies which would be able to develop and export services;
-creation of laboratory services with world-class capability;
-stimulants for economic activities;
-specialization and improvement of services.

Short term operating cost savings would probably not ensue, but very considerable long term capital savings would be expected from improved maintenance and real integration of maintenance costs into user rates. (- see "Water Use in New Brunswick" report to the Office of Government Reform).

An interesting offshoot of the creation of contracting utilities at home is the potential to access the rapidly growing international market for provision of such services in developing countries. Initiatives have already been taken in this regard by several Provinces - see "International Opportunities for Canada's Environmental Industry"

It is recommended that the Province undertake a study of the feasibility of privatization of those sectors of the Environmental Industry which are currently operated by departments or publicly-owned agencies.

It is recommended that the Province form a study group composed of at least 2/3 private sector entrepreneurs, that it be empowered to obtain information on the successes and failures of privatization programs elsewhere and that it be provided with an adequate secretariat and budget.

Barriers, disincentives, incentives

The Government of Canada currently charges import duty on certain secondary material commodities which are being brought into New Brunswick for remanufacture into consumer products. Much of the product is exported to the United States. In each known case, there is not enough such material being collected in the Region to satisfy the need of the re-manufacturer.

Importation of scrap material is not necessarily bad. Definitions are sometimes applied which classify otherwise recyclable material as garbage. This may bar the transportation of useful scrap material needed for remanufacturing.

There are also trans-border barriers to the movement of personnel and specialized equipment in the field of environmental testing and monitoring. This work requires the temporary relocation of operators from New Brunswick who are frustrated in obtaining work permits.

The purchasing power of governments, provincial and municipal, public agencies and institutions such as schools, hospitals and universities could have a major positive effect on the demand for supplies containing a high percentage of post-consumer secondary resources. The perception that recycled content automatically results in an inferior product is fading.

The purchasing policy should give preference to products with a high recycled content including bond paper, envelopes, towels, tissue, egg trays and cartons; re-built items such as retreaded tires; re-fined lubricating oil; and more. The policy should also aim to reduce the undesirable content of recyclable material such as instant seal and plastic windows in envelopes, highly coloured paper and strengthening cords in beer boxes.

One provincial agency refuses to accept plastic bags with any secondary content although it can be demonstrated that bags can be made with equal strength using up to 50% of recycled plastic.

The hierarchy of waste management practices is widely accepted as:

reduce
reuse
recycle
incineration (with energy recovery)
landfill

In order to influence behaviour, governments can add surcharges to undesirable activities and add incentives to encourage public change in a positive direction. Current provincial policy of subsidizing landfills is counterproductive. Tipping fees at the true costs or higher would encourage more recycling and less waste. The money saved by removal of this subsidy could better be used in education to promote the 3-Rs and to more imaginative 3-R initiatives.

Industry is greatly encouraged and supported when government adopts locally developed technology. Especially in the earlier stages when markets are difficult it would be very helpful to the export market if there were working installations back home.

It is recommended that the Province review various government policies which impact on the environmental industry and institute a system of incentives/disincentives to meet environmental goals and allow market forces to work.

It is recommended that the Province continue and increase incentives and support toward enhancement of the more desirable forms of waste management according to the accepted hierarchy.

Industry By-Products

Industries generate waste material which are of no value to its main function. If an economic use can be found for this material, either in-house or elsewhere, it is classified as a by-product. If no use can be made of the material it is a waste and usually goes to a landfill or becomes an unsightly and sometimes environmentally damaging dump.

Often a portion of this material is recyclable in the usual stream; paper, packaging, etc. This section deals with the after-products of industrial activity.

Technology to transform certain of these waste materials into useful products may be available but unused because of ignorance, tradition or inertia. In other instances, new technologies could be developed. Successfully demonstrated, these technologies could be exportable world-wide.

One of these opportunities could be in the extraction of other metals from mine tailings, or perhaps improved means to extract a higher percentage of the principal metals.

Another is the processing of fish waste products into non-traditional uses. Fish portions not suitable for the primary market are nutritious as a food and may contain high levels of OMEGA-3 fats which are desirable to reduce cholesterol. Fish waste can be used for animal food supplements or as fertilizer. Fish skins may be processed into exotic leathers.

Certain chemical waste could be feed-stock for other processes.

It is recommended that the Province undertake an inventory of industrial waste generation and that studies be undertaken to assess the quality and quantity of each source for possible commercialization. It is further recommended that support be given to the establishment of a By-products Exchange in the Province.

ENVIRONMENTAL RESEARCH

Private Sector R&D Organization

The Environmental Industry in New Brunswick is dominated by a growing number of professional service firms that offer services in data collection, waste management, waste treatment and remediation. In addition to the positive impact of their work on the environment, these persons contribute significantly to the economy of the province. They offer high quality employment opportunities for technical and university graduates, achieve a high multiplier effect through their subcontracting for technical services and purchases of advanced technology equipment, and bring work into New Brunswick from other provinces and countries.

Many of these firms are R&D intensive. Their products and services must be supported by on-going R&D in order to respond to new applications and to more stringent environmental resolutions affecting their industrial clients. Their ability to perform this sustaining R&D, and to apply the results through demonstration projects, is often the ultimate limit on the growth potential of these firms.

There is an opportunity for government to stimulate the growth of this important component of the Environmental Industry by facilitating the performance of R&D by these firms. The introduction of R&D incentives that are tailored specifically to meeting the needs of firms in the service sector is an urgent priority.

Most R&D incentives offered by government are structured for the manufacturing sector. (NRC's IRAP and ACOA's Innovation Element are the most widely available.) They are intended to provide a contribution (50 to 60 percent) to the direct incremental cost of performing an R&D activity. Persons in the professional service sector require an incentive that recognizes the total cost of undertaking R&D (including overhead) and which provides a relatively high contribution toward these total costs.

Professional service firms have looked into federal R&D contracts administered through Supply and Services Canada as a way of obtaining needed support for R&D in the past. These contracts fund 100 percent of the cost of an R&D project. However, cutbacks in government spending have drastically reduced the availability of contract R&D funding. The Unsolicited Proposal Program that funded worthy ideas put forward by individual firms was eliminated entirely in 1989. This program was widely used by professional service firms in the Environmental Industry of the Atlantic Region to develop new products and services.

It is recommended that the Province introduce an R&D incentive similar to the Unsolicited Proposal Program that can be accessed by persons in the Environmental Industry in New Brunswick. The essential features are that the program should recognize the total cost of the R&D project (including overhead) and that it should fund nearly 100 percent of the total cost of the project.

One mechanism for establishing the R&D incentive would be through a renewed Industrial Innovation and Technology Development Sub-agreement.

Universities and Provincial Research Organizations

More and more in New Brunswick and elsewhere, University-Industry interaction is being recognized as crucial to economic development and growth. For rapid growth, the environmental industry needs to be supported by sound research and development activities. Universities in New Brunswick should pick up the challenge and develop R&D expertise to accompany this developing industry. There is already a solid R&D base in New Brunswick universities in terms of science and engineering. Efforts should be made to inform the industry of this specialized expertise. It may be necessary to reinforce the infrastructure of some university-based R&D centres to increase efficiency. Thus it will be necessary to ensure that government programs enable industry to complement their R&D requirements through affiliation with properly equipped universities.

Each University already has capabilities in diverse fields. It would be desirable to build on strength and not try to duplicate expertise and facilities which currently exist. The Environmental Industry is very broad in its dependence on fundamental specialty fields. No one institution should be expected to deal with all the problems which might arise for solution. A mechanism should be found which would bring industry and researchers closer together so that problems and opportunities may be identified and assigned to those who are perceived to have the greatest likelihood of a positive solution.

Provincial research organizations have a major role to play in assisting the private sector to perform R&D. Such organizations are usually well equipped and possess expertise that should not be duplicated. It is not suggested that such organizations (or universities) have direct access to funding reserved for the private sector, but they could certainly provide a service to the industry under contract.

It is recommended that the Province, in consultation with the universities and industry, establish a system for grants to individual researchers based on proposals which would demonstrate the potential for commercialization.

It is recommended that Governments continue to assist in the funding of universities' environmental research infrastructures.

It is recommended that the Province increase support for developmental research proposed jointly by industry associations, industries and universities.

It is recommended that the Province continue to support Provincial research organizations in terms of infrastructure.

APPENDIX

The following is a listing of the products and services which might be applicable to the Environmental Industry in New Brunswick.

Products

1.0 Air pollution control

1.2 Air Handling Equipment

- 1.2.1 Blowers
- 1.2.2 Dampers
- 1.2.3 Ducts, stacks and accessories - metal
- 1.2.4 Ducts, stacks and accessories - non-metal
- 1.2.5 Fans
- 1.2.6 Gas cooling systems
- 1.2.7 Hoods
- 1.2.10 Other air handling equipment components

1.4 Chemical Recovery Systems

- 1.4.1 Flue gas desulphurization systems
  - 1.4.1.1 Caustic/lime scrubbing systems
  - 1.4.1.2 Sulphuric acid plant systems
  - 1.4.1.3 Other flue gas desulphurization systems
- 1.4.2 Hydrogen sulphide removal systems
- 1.4.3 Solvent recovery systems
- 1.4.10 Other chemical recovery systems

1.6 Computer Software Programs

1.7 Electrostatic Precipitator

- 1.7.1 Electrostatic precipitator - commercial/residential
- 1.7.2 Electrostatic precipitator - industrial

1.9 Air pollution Filter Accessories/Media

- 1.9.1 Filter accessories
  - 1.9.1.2 Shakers/rappers

Products

1.9.1.3 Bag cages
1.9.1.4 Conveyors
1.9.1.5 Air dryers
1.9.1.6 Panels
1.9.1.7 Scrapers

1.9.2 Filter media
1.9.2.1 Activated alumina/carbon/silica
1.9.2.2 Anthracite
1.9.2.3 Cartridges
1.9.2.4 Fabric (bags)
1.9.2.5 Fibreglass
1.9.2.6 Gravel
1.9.2.7 Paper
1.9.2.10 Other

1.11 Scrubbers - Dry

1.11.1 Impingement
1.11.2 Other

1.12 Scrubbers - Wet

1.12.1 Atomizing
1.12.2 Centrifugal
1.12.3 Contact
1.12.4 Deflector
1.12.5 Ejector
1.12.6 Impingement
1.12.7 Movable Bed
1.12.8 Packed bed/Column
1.12.9 Plate Column
1.12.10 Spray Chamber
1.12.11 Venturi
1.12.15 Other

2.0 Water Pollution Control

2.1 Aeration Systems

Products

- 2.1.1 Diffused
- 2.1.2 Disc
- 2.1.3 Dome
- 2.1.4 Fixed
- 2.1.5 Floating
- 2.1.6 Submerged
- 2.1.7 Surface
- 2.1.10 Other

2.2 Biological Treatment Systems

2.5 Chemical Recovery Systems

- 2.5.1 Acid regeneration/recovery systems
- 2.5.2 Chemical recovery systems (eg. Pulp and Paper Mill chemicals)
- 2.5.3 Metal compound recovery systems (eg. Chromates)

2.6 Computer Software Programs

2.7 Filters

- 2.7.1 Anthracite
- 2.7.2 Bag
- 2.7.3 Belt
- 2.7.4 Cartridge
- 2.7.5 Centrifugal
- 2.7.6 Deep-bed
- 2.7.7 Diatomaceous earth
- 2.7.8 Disk
- 2.7.9 Dual media
- 2.7.10 Gravity
- 2.7.11 Hi-rate sand
- 2.7.12 Leaf
- 2.7.13 Membrane
  - 2.7.13.1 Microfiltration
  - 2.7.13.2 Reverse osmosis
  - 2.7.13.3 Ultrafiltration
  - 2.7.13.10 Other

Products

2.7.14 Panel
2.7.15 Plate
2.7.16 Pressure
2.7.17 Sand
2.7.18 Trickling
2.7.19 Vacuum
2.7.25 Other
2.7.30 Filtration system, package commercial/residential

2.8 Filter Media

2.8.1 Activated carbon/silica
2.8.2 Anthracite
2.8.3 Diatomaceous earth
2.8.4 Fibreglass
2.8.5 Metallic fibre
2.8.6 Natural fibre
2.8.7 Paper
2.8.8 Plastic
2.8.9 Sand/gravel
2.8.10 Synthetic fibre
2.8.11 Wire cloth
2.8.20 Other

2.9 Gravity Sedimentation systems

2.9.1 Clarifiers
2.9.2 Flotation equipment
2.9.2.1 Coagulation
2.9.2.2 Dissolved air
2.9.2.3 Electro
2.9.2.4 Flocculation
2.9.2.5 Induced air
2.9.2.10 Other

2.9.3 Lagoons and lagoon equipment
2.9.10 Other

2.10 Ion Exchange Systems

Products

2.11 Oil/Water Separation Equipment

- 2.11.1 Filters/separators
- 2.11.2 Oil spill control
  - 2.11.2.1 Boats
  - 2.11.2.2 Booms
  - 2.11.2.3 Dispersants
  - 2.11.2.4 Skimmers
  - 2.11.2.5 Sorbents
  - 2.11.2.6 Tanks
  - 2.11.2.7 Underground recovery
  - 2.11.2.99 Other

2.12 Potable/Process Water Treatment Systems

- 2.12.1 Potable water treatment systems - commercial/residential
- 2.12.2 Potable water treatment systems - industrial
- 2.12.3 Potable water treatment systems - municipal
- 2.12.5 Potable water treatment systems - other
- 2.12.6 Process water purification systems - industrial
  - 2.12.6.1 Boiler feed water systems
  - 2.12.6.2 Process water purification systems - industrial - other
- 2.12.8 Water softeners - commercial/residential
- 2.12.9 Water softeners - industrial

2.14 Sewage Treatment Equipment

- 2.14.1 Comminutors & sewage grinders
- 2.14.2 Septic treatment
  - 2.14.2.1 Septic Tanks
    - 2.14.2.1.1 Concrete
    - 2.14.2.1.2 Steel
    - 2.14.2.1.99 Other

2.15 Sewage Treatment Systems

- 2.15.1 Sewage lift stations
  - 2.15.1.1 Sewage lift stations - packaged

Products

2.15.2 Sewage treatment systems - municipal
2.15.2.1 Sewage treatment systems - packaged - commercial/residential
2.15.2.2 Sewage treatment systems - packaged - other

2.17 Water Purification Systems and Equipment

2.17.1 Ion exchange (demineralizer) systems
2.17.2 Desalination systems
2.17.3 Disinfection equipment
2.17.3.1 Fluoridators
2.17.3.2 Hypo-chlorinators
2.17.3.3 Ozonators
2.17.3.4 Ultraviolet
2.17.3.99 Other

2.17.4 Distillation systems
2.17.5 Sterilization systems - commercial/ residential

3.0 Waste Management

3.1 Computer Software programs

3.3 Recycling Systems and Equipment

3.3.1 Can recycling systems and equipment
3.3.2 Glass recycling/recovery systems and equipment
3.3.3 Metals recycling/recovery systems and equipment
3.3.3.1 Ferrous
3.3.3.2 Aluminum
3.3.3.3 Other non-ferrous

3.3.4 Oil recycling systems and equipment
3.3.5 Paper recycling systems and equipment
3.3.6 Plastics recycling/recovery systems and equipment
3.3.7 Rubber recycling/recovery systems and equipment

Products

3.3.8 Energy-from-waste systems & equipment
3.3.99 Other recycling systems and equipment

3.6 Waste Disposal Systems and Equipment

3.6.1 Composting systems and equipment
3.6.2 Lagoon systems and equipment
3.6.3 Land application systems and equipment
3.6.4 Landfill systems and equipment
3.6.5 Liners
3.6.5.1 Natural (bentonite/imported clay)
3.6.5.2 Synthetic
3.6.5.5 Other

3.6.6 Sewage sludge disposal systems and equipment
3.6.10 Other waste disposal systems and equipment

3.8 Waste Separation Systems and Equipment

3.8.1 Separation systems
3.8.1.1 Solid-solid, ferrous metal
3.8.1.2 Solid-solid, nonferrous metal
3.8.1.3 Solid-solid, non-metal

3.8.2 Separators
3.8.2.1 Air classifiers
3.8.2.2 Centrifugal
3.8.2.3 Impingement
3.8.2.4 Inclined plate
3.8.2.5 Magnetic
3.8.2.6 Vibratory

5.0 Chemicals for Pollution Control

5.1 Absorbents/Adsorbents

5.3 Bacteria/Enzymes

5.7 Water Treatment

Products

5.7.1 Acids
- 5.7.1.1 Hydrochloric acid
- 5.7.1.2 Phosphoric acid
- 5.7.1.3 Sulphuric acid
- 5.7.1.10 Other acids

5.7.2 Algae treatment chemicals
5.7.3 Aluminum ammonium sulphate
5.7.4 Aluminum sodium sulphate
5.7.5 Ammonium fluosilicate
5.7.6 Ammonium sulphate
5.7.7 Biocide, industrial
5.7.8 Calcium chloride, dry
5.7.9 Calcium hydroxide
5.7.10 Calcium hypochlorite
5.7.11 Calcium oxide (lime)
5.7.12 Catalysts
5.7.13 Chlorine
5.7.14 Copper sulphate
5.7.15 Disinfectants
5.7.16 Emulsifiers
5.7.17 Emulsion breakers
5.7.18 Ferrous chloride
5.7.19 Ferric chloride
5.7.20 Flocculants/coagulants
5.7.21 Flotation chemicals
5.7.22 Fluorides
- 5.7.22.1 Calcium fluoride
- 5.7.22.2 Sodium fluoride
- 5.7.22.5 Other fluorides

5.7.23 Foam/Grease Control
- 5.7.23.1 Antifoaming agents
- 5.7.23.2 Defoaming agents, prepared

5.7.24 Fungicides, industrial
5.7.25 Germicides, industrial
5.7.26 Hydrogen perioxide
5.7.27 Ion exchange resins

Products

5.7.28 Iron hydroxides
5.7.29 Iron oxides
5.7.30 Magnesium silicates
5.7.31 Nutrient removal chemicals
5.7.32 Odour/taste control chemicals
5.7.33 Precipitating agents
5.7.34 Potassium permanganate
5.7.35 Scale control chemicals
5.7.36 Slimicides, industrial
5.7.37 Sludge Stabilizers
5.7.38 Sodium aluminate
5.7.39 Sodium carbonate (soda ash)
5.7.40 Sodium chloride
5.7.41 Sodium chlorite
5.7.42 Sodium hydroxide, dry
5.7.43 Sodium hydroxide, liquid
5.7.44 Sodium hypochlorite
5.7.45 Sodium metasilicates
5.7.46 Sodium silicate
5.7.47 Sodium silicofluoride
5.7.48 Solvents
5.7.49 Sulphur dioxide
5.7.50 Surfactants
- 5.7.50.1 Surfactants, anionic
- 5.7.50.2 Surfactants, cationic
- 5.7.50.3 Surfactants, compounded ind.
- 5.7.50.4 Surfactants, non-ionic
- 5.7.50.5 Surfactants, olefin sulphonate
- 5.7.50.6 Surfactants, sulphate base
- 5.7.50.7 Surfactants, sulphonate base

5.7.60 Other water treatment chemicals

5.8 Other chemicals

5.8.1 Alumina, activated
5.8.2 Ammonia, anhydrous, liquid
5.8.3 Ammonia, gas
5.8.4 Carbon, activated

Products

5.8.5 Clay, activated
5.8.6 Diatomaceous earth
5.8.7 Diatomite, activated
5.8.8 Earths, activated
5.8.9 Oxygen
5.8.10 Ozone
5.8.11 Silica gel, colloidal
5.8.12 Silica gel, hydrated
5.8.13 Zeolite

6.0 Instruments for Pollution Control

6.1 Measuring and Monitoring Instruments

6.1.1 Air Quality and Emission Parameters
6.1.1.1 Air velocity
6.1.1.2 Deposition
6.1.1.2.1 Dry
6.1.1.2.2 Wet
6.1.1.3 Flow, air/gas
6.1.1.4 Gas analysis
6.1.1.5 Humidity
6.1.1.6 Opacity
6.1.1.7 Particle size
6.1.1.8 Precipitation
6.1.1.9 Pressure/vacuum
6.1.1.10 Temperature
6.1.1.20 Other

6.1.2 Air Pollutant Detection/Measurement
6.1.2.1 Aerosols
6.1.2.2 Carbon dioxide
6.1.2.3 Carbon monoxide
6.1.2.4 Chlorine
6.1.2.5 Combustible gas
6.1.2.6 Heavy metals
6.1.2.7 Hydrocarbons
6.1.2.8 Hydrogen sulphide
6.1.2.9 Nitrogen Oxide

Products

6.1.2.10 Oxygen
6.1.2.11 Ozone
6.1.2.12 Particles
6.1.2.13 Radiation
6.1.2.14 Sulphate/sulphide
6.1.2.15 Total sulphur
6.1.2.16 Toxic gas
6.1.2.20 Other

6.1.3 Groundwater Parameters
6.1.3.1 Conductivity
6.1.3.2 Contaminant tracers
6.1.3.3 Depth to water sounding
6.1.3.4 Dissolved oxygen (downhole)
6.1.3.5 Eh/pH (downhole)
6.1.3.6 Flow
6.1.3.7 Geophysical (downhole)
6.1.3.7.1 Gamma
6.1.3.7.2 Neutron
6.1.3.7.3 Resistivity
6.1.3.7.4 SP
6.1.3.8 Hydrocarbons
6.1.3.9 Landfill leaks
6.1.3.10 Level
6.1.3.11 pH (downhole)
6.1.3.12 Temperature (downhole)

6.1.4 Meteorological Instruments
6.1.4.1 Measuring and recording instruments
6.1.4.1.1 Anemometers
6.1.4.1.2 Balloon-related equipment and instruments
6.1.4.1.3 Barographs
6.1.4.1.4 Barometers
6.1.4.1.5 Hydrometers
6.1.4.1.6 Precipitation gauges
6.1.4.1.7 Sunshine recorders
6.1.4.1.8 Temperature measuring and

recording instruments
6.1.4.2 Communications equipment and systems
6.1.4.3 Computer hardware
6.1.4.4 Computer software

6.1.5 Noise Measurement and Monitoring Instruments
6.1.6 Water Quality and Emission Parameters
6.1.6.1 Colour
6.1.6.2 Conductivity
6.1.6.3 Flow
6.1.6.3.1 Closed pipe
6.1.6.3.2 Open channel
6.1.6.4 ORP
6.1.6.5 pH
6.1.6.6 Total oxygen demand
6.1.6.7 toxicity (bioassay)
6.1.6.8 Turbidity
6.1.6.9 Viscosity
6.1.6.10 Water hardness
6.1.6.11 Zeta potential
6.1.6.99 Other

6.1.7 Water Pollutant Detection/Measurement
6.1.7.1 BOD
6.1.7.2 COD
6.1.7.3 Dissolved oxygen
6.1.7.4 Dissolved solids
6.1.7.5 Heavy metals
6.1.7.6 Sulphate/sulphide
6.1.7.7 Total carbon
6.1.7.8 Total nitrogen
6.1.7.99 Other

6.2 Sampling Systems and Equipment

6.2.1 Sampling Systems
6.2.1.1 Ambient air
6.2.1.2 Groundwater

Products

6.2.1.3 Sediments
6.2.1.4 Sludge
6.2.1.5 Soil
6.2.1.6 Stack
6.2.1.7 Tank/drum
6.2.1.8 Wastewater
6.2.1.9 Water
6.2.1.10 Other

6.2.2 Sampling Equipment and Accessories
6.2.2.1 Bailers
6.2.2.2 Drilling equipment
6.2.2.2.1 Drilling rigs
6.2.2.2.2 Downhole samplers (groundwater)
6.2.2.3 Flowmeters
6.2.2.4 Pore water samplers
6.2.2.5 Pumps
6.2.2.99 Other

6.3 Process and Equipment Control Equipment

6.3.1 Combustion controls
6.3.2 Computer controls
6.3.3 Process control
6.3.3.1 electromechanical
6.3.3.2 Electronic, analog
6.3.3.3 Electronic, digital
6.3.3.4 Programmable controllers

6.3.4 Sensors
6.3.4.1 Flow
6.3.4.2 Level
6.3.4.3 pH
6.3.4.4 Pressure
6.3.4.5 Temperature
6.3.4.10 Other

6.4 Data Acquisition Equipment

Products

6.4.1 Display systems
6.4.2 Data loggers
6.4.3 Microcomputers
6.4.4 Recorders
6.4.5 Telemetry systems
6.4.10 Other

7.0 Scientific, Research and Laboratory

7.6 Laboratory Reagents and Supplies

7.6.1 Bacteriological supplies
7.6.2 Laboratory chemicals
7.6.3 Laboratory reagents
7.6.4 Other laboratory supplies

8.0 Natural Resource Conservation and Protection

8.1 Reforestation

8.1.1 Tree nursery equipment
8.1.2 Tree Planting Equipment

8.2 Remote Sensing and Image Analysis

8.2.1 Remote sensing and image analysis equipment

8.3 Computer software for natural resource conservation and protection

Services

1.0 Consultant Services

1.1 Consulting Engineering Services

- 1.1.1 Pre-feasibility/Feasibility Studies
- 1.1.2 Site Assessment
- 1.1.3 Design and Specifications
- 1.1.4 Earthquake Engineering
- 1.1.5 Process Evaluation & Selection
- 1.1.6 Project Management
- 1.1.7 Construction Management
- 1.1.8 Plant Retrofit Studies
- 1.1.9 Site Reclamation and Remedial Action
- 1.1.10 Microclimate Assessment
- 1.1.11 Permafrost Engineering
- 1.1.12 Research and Development

1.2 Consulting Services - Environmental

- 1.2.1 Alternate Energy Sources
- 1.2.2 Clean-up Criteria Development
- 1.2.3 Contingency Planning for Spills
- 1.2.4 Emergency Response Planning
- 1.2.5 Energy Conservation
- 1.2.6 Environmental Audits
- 1.2.7 Environmental Baseline Studies
- 1.2.8 Environmental Control Strategies
- 1.2.9 Environmental Impact Assessments
- 1.2.10 Environmental Impact Studies
- 1.2.11 Environmental Law
- 1.2.12 Environmental Modelling
- 1.2.13 Environmental Monitoring
- 1.2.14 Environmental Permitting
- 1.2.15 Environmental Regulations and Standards
- 1.2.16 Environmental Standards
- 1.2.17 Expert Testimony
- 1.2.18 Geophysical
- 1.2.19 Pollutant Transport/Transformation Studies
- 1.2.20 Risk Management

Services

1.2.21 Spills Assessment and Clean-up
1.2.22 Toxicology
1.2.23 Underground Storage Tank Management

1.3 Consulting Services - Waste Management

1.3.1 Aquifer Remediation
1.3.2 Asbestos Abatement
1.3.3 Energy from Waste
1.3.4 Hazardous or Toxic (eg. PCBs or Lead)
1.3.5 Industrial (Non-Hazardous)
1.3.6 Mine Tailings Disposal
1.3.7 Municipal Solid Waste
1.3.8 Ocean Dumping and Dredging
1.3.9 Radioactive
1.3.10 Recycling
1.3.11 Sewage

1.4 Consulting Service - Other

1.4.1 Computer Software (including expert systems)
1.4.2 Computer Systems
1.4.3 Data Base Management Systems
1.4.4 Economic Analysis
1.4.5 Environmental Data Acquisition Systems
1.4.6 Financial Analyses
1.4.7 Government Policy
1.4.8 Indoor Air Quality
1.4.9 Market Analyses
1.4.10 Socio-Economic Studies
1.4.11 Technology Transfer
1.4.12 Training

2.0 Pollution Assessment and Control

2.1 Air Quality Assessment

2.1.1 Ambient
2.1.2 Indoor

Services

2.3 Pollution Control

- 2.3.1 Air Pollution
- 2.3.2 Noise Pollution
- 2.3.3 Soil/Land Pollution
- 2.3.4 Waste Management
- 2.3.5 Water Pollution
  - 2.3.5.1 Ground Water
  - 2.3.5.2 Surface Water

2.4 Source Characterization

2.5 Waste Surveys and Characterization

2.6 Water Quality Assessment

- 2.6.1 Surface Water
- 2.6.2 Ground water

4.0 Waste Handling and Environmental Facility Operation

4.1 Emergency Response and Spill Clean-up

4.2 Integrated Special Waste Management/Treatment Facilities

4.3 Potable Water

4.4 Recycling

- 4.4.1 Recycling Plants
- 4.4.2 Transfer Stations
- 4.4.3 Waste Brokers
- 4.4.4 Waste Separation Plants

4.5 Waste Management

- 4.5.1 Chemical/Physical Waste Treatment Plants
- 4.5.2 Cogeneration/Trigeneration Plants
- 4.5.3 Composting

Services

4.5.4 Energy-from-Waste Plants
4.5.5 Sanitary Landfills
4.5.6 Septic Tank Pumping and Disposal Services
4.5.7 Sewage Treatment Plants
4.5.8 Waste Collection
4.5.9 Waste Incinerators
4.5.10 Waste Handling (including compacting) and Transport
4.5.11 Waste Sorting and Segregation

5.0 Laboratory and Related Field Services

5.1 Laboratory Services

5.1.1 Analytical Services
5.1.2 Analytical Method Development
5.1.3 Environmental Research
5.1.4 Quality Assurance/Quality Control

5.2 Sampling, Monitoring and Measurements Services (Field)

5.2.1 Ambient Air
5.2.2 Ground Water
5.2.3 Indoor Air
5.2.4 Noise and Vibration
5.2.5 Radioactivity
5.2.6 Soil
5.2.6.1 Surface
5.2.6.2 Subsurface

5.2.7 Surface Water
5.2.8 Stack Emissions
5.2.9 Water Effluent

6.0 Environmental Research

6.1 Federal Government

6.1.1 Agriculture Canada
6.1.2 Energy, Mines and Resources

Services

6.1.3 Environment Canada
6.1.4 Fisheries and Oceans
6.1.5 Forestry Canada
6.1.6 Health and Welfare Canada
6.1.7 National Defence
6.1.8 National Research Council
6.1.9 Transport Canada

6.2 Private Sector

6.3 Provincial Government

6.4 University

7.0 Natural Resource Conservation and Protection

7.1 Agriculture

7.1.1 Agricultural Soil and Water Conservation
7.1.2 Organic Agriculture

7.2 Fisheries

7.2.1 Aquaculture
7.2.2 Fisheries Management

7.3 Forestry

7.3.1 Forestry Conservation and Protection
7.3.2 Reforestation

7.4 Land

7.4.1 Flood Plain Control
7.4.2 Geographic Information Systems
7.4.3 Mapping and Resources, Land Types or Land Use
7.4.4 Rural Land Management
7.4.4.1 Woodlot Management

Services

7.5 Marine

- 7.5.1 Coastal Areas and Shoreline Management
- 7.5.2 Oceanography/Hydrography

7.6 Water Resources

- 7.6.1 Aquifer Protection and Restoration
- 7.6.2 Hydrogeology/Ground Water Management
- 7.6.3 Hydrology/Limnology
- 7.6.4 Water Resources Planning and Management
- 7.6.5 Water Supply and Treatment

7.7 Other Natural Resource Conservation and Protection

- 7.7.1 Ecosystem Studies and Biological Assays
- 7.7.2 Natural Area Parks, Recreation and Tourism
- 7.7.3 Meteorology/Climatology
- 7.7.4 Pest Control
- 7.7.5 Remote Sensing and Image Analysis
- 7.7.6 Resource Management
  - 7.7.6.1 Arctic Resources Management
  - 7.7.6.2 Integrated Resource Management
- 7.7.7 Wildlife and Natural Habitat Enhancement

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